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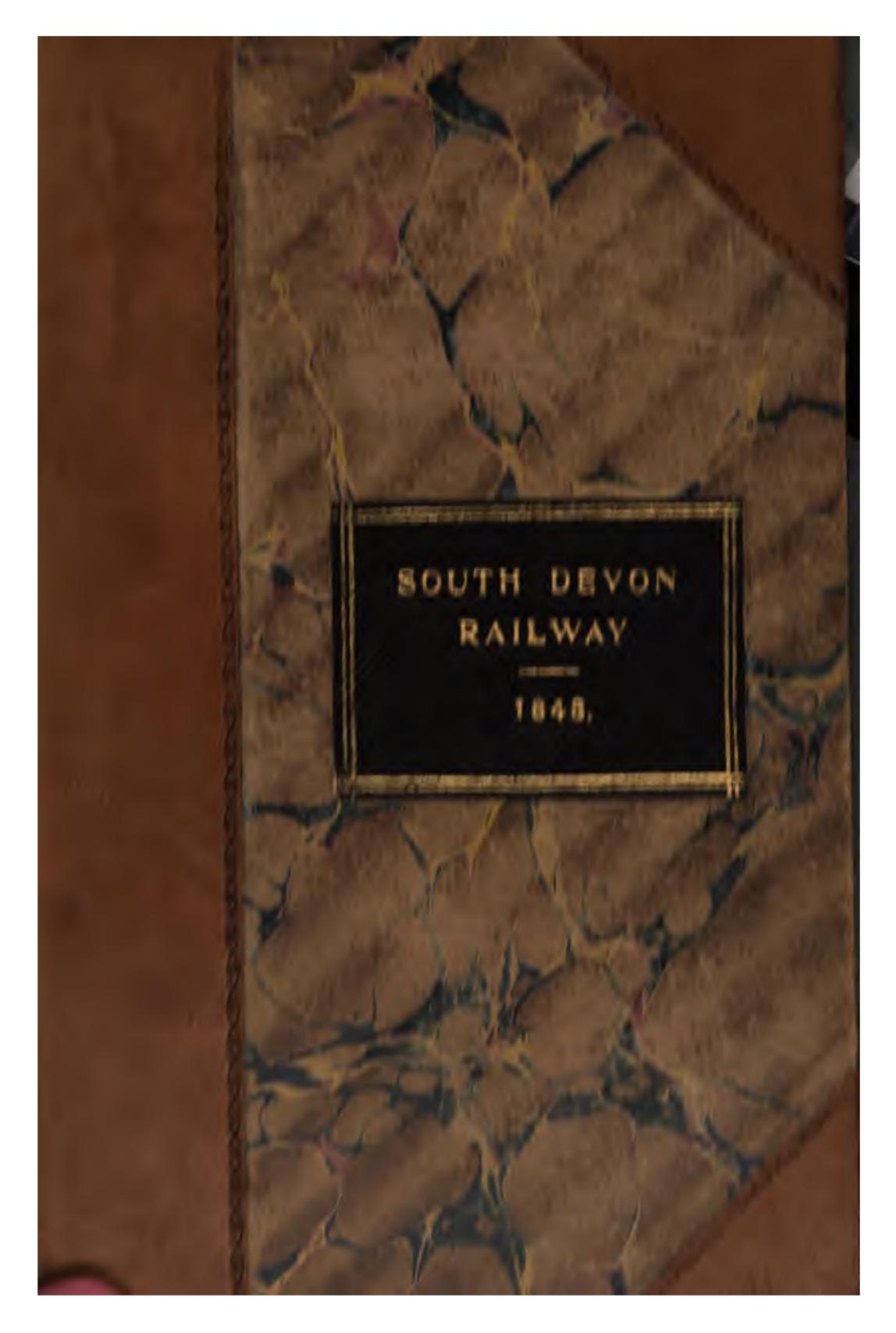
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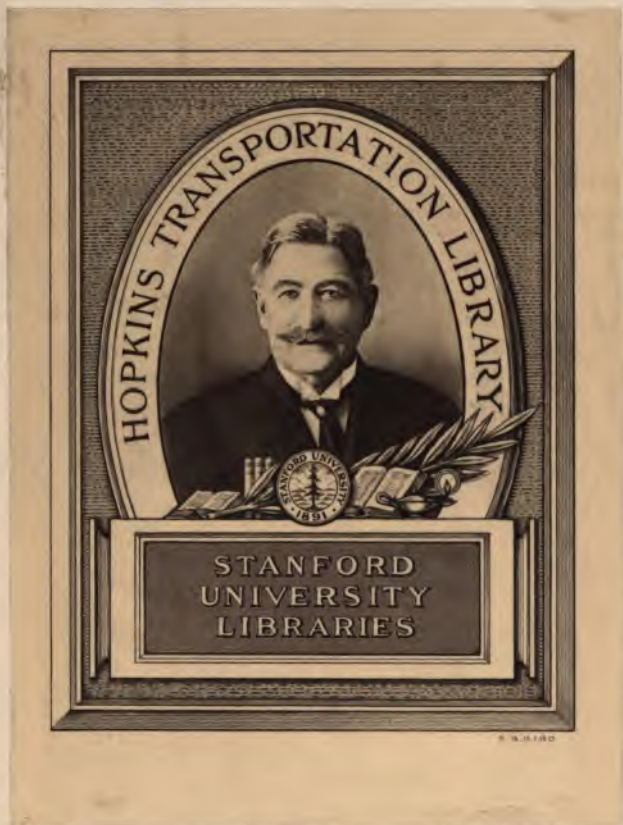
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The image shows the front cover of an old book. The cover is bound in brown leather, with a decorative marbled paper label in the center. The marbling features a pattern of brown, tan, and blue-grey veins. The title label is rectangular with a double-line gold border. The text on the label is in a serif font, with 'SOUTH DEVON' and 'RAILWAY' on the top two lines, and '1848,' on the bottom line. A small horizontal line separates the title from the year.

SOUTH DEVON
RAILWAY

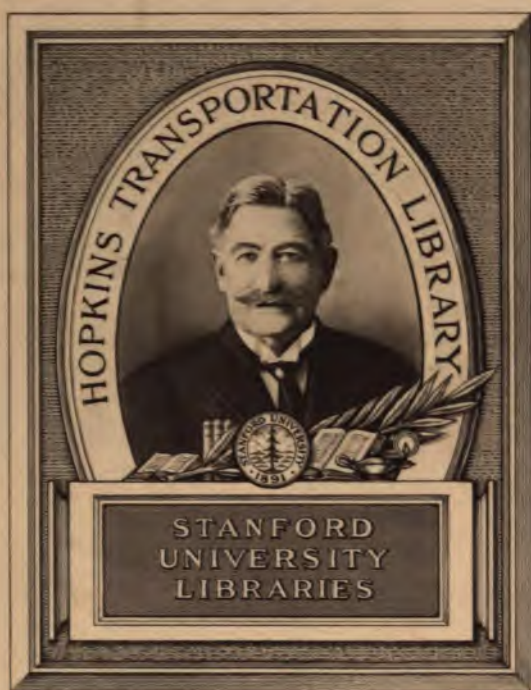
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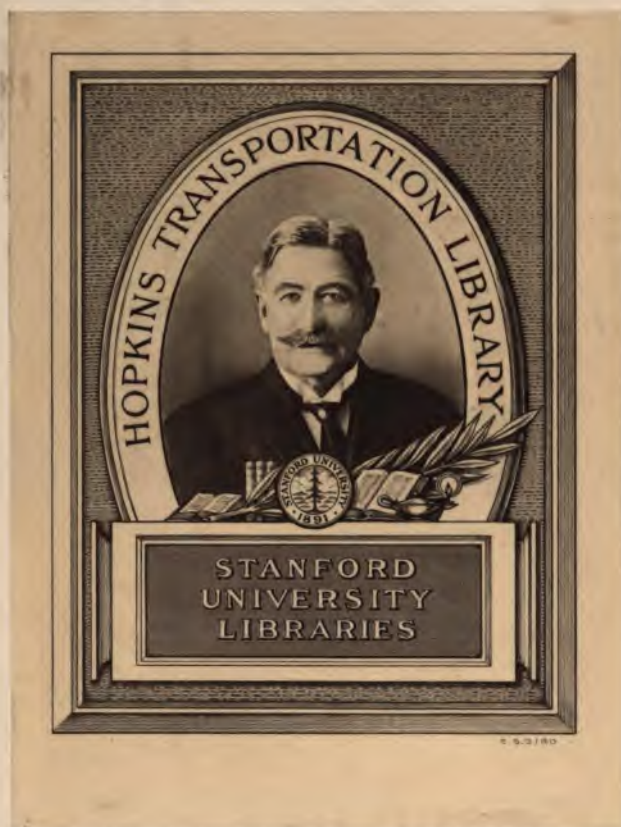
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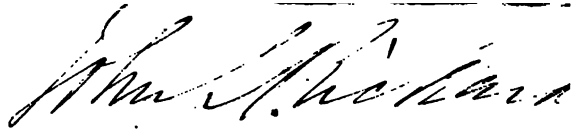
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ADDRESS

TO

THE PROPRIETORS

OF THE

SOUTH DEVON RAILWAY.

BY THE

CHAIRMAN OF THE BOARD OF DIRECTORS.

PLYMOUTH :

ROGER LIDSTONE, GEORGE STREET.

LONDON :

EFFINGHAM WILSON, ROYAL EXCHANGE.

1848.

LONDON
GEORGE WOODFALL AND SON,
ANGEL COURT, SKINNER STREET.

PREFACE.

THE perusal of a clever and pungent little pamphlet recently published, entitled "Railway Rescue: a Letter to the Railway Directors of Great Britain,"* which begins in a vein of humorous but caustic irony on Railway Shareholders, has led me to attempt their "rescue" from obloquy so undeserved. This attempt being the more incumbent upon me, inasmuch as it is to this "arithmetical nil" I am about to address myself.

That they are what the writer so pithily describes them to be, may be true in reference to the few, and in some localities, but if we are to judge from the experience of the past, it must be admitted, I think, that, of all classes of men who have property invested in these and similar undertakings, there are none who have evinced so keen a sensibility to every circumstance which may in any degree affect the value of their property, as the large majority of Shareholders in Railways.

That the Reports of Directors at half-yearly meetings are received generally with satisfaction by the assembled Proprietors, is a fact which indicates merely the measure of confidence reposed in them, and as long as a favourable balance sheet is exhibited, few persons think it necessary to propose questions which may be deemed troublesome or distasteful to the Board;

* "It is the fashion for those who imagine they have something to say on railway subjects, to address themselves to the Shareholders; I prefer to speak to you, having come to the conclusion that Shareholders are practically an arithmetical *nil*—a fluctuating body of sheep-men, here to-day and gone to-morrow; now jumping through a hedge-gap into a rich pasture, and anon floundering in an impracticable marsh, without the wit to understand that the pasture of this quarter may be the marsh of next quarter, and *vice versa*. In short, they merely play the game of 'follow my leader' at the sport of chance. They are a passive and not an active body, buying when shares are up in the market, and selling when they are down. They are in short that nobody, the public, whom all active men, with intellectual faculties alert, and moral faculties dormant, consider to be 'their oyster,' which they, not 'with sword,' as in the olden time—but with cunning, after modern fashion, 'will open.'"

the reverse side of the picture, however, gives a very different result. That the dissatisfaction which is often expressed on such occasions may be attributed to one fact, will hardly be doubted; viz., the close borough system which is observed, I believe, by all Boards of Directors in Great Britain, in the *re-election* of those of their body whose turn it is to vacate office. I am of opinion that no one circumstance would tend so largely to inspire universal confidence amongst the Proprietary in the management of their affairs, as the occasional infusion of new blood into the directing body; aware of the objection, and, I believe, the only one, which may be urged to this innovation, I am prepared with its antidote. The objection is, that the introduction of novitiates into the governing body will, for some time, throw a greater amount of duty upon the older members of the Board than is either convenient or agreeable. To those who know anything of the composition of most Boards, this objection will be regarded as puerile.

The antidote, however, is, to restrict the annual election of new members to one-fifth or one-sixth of the whole number of the Board.

Many and great advantages would result from such a course.

It may be a matter of surprise to some, that, being at issue with the majority of the Board over whom I presided upon a question of vital importance, I continued to retain the chair. It was my determination to resign it at the first meeting of the Board after the meeting of Shareholders on the 29th of August, and it was only at the earnest desire of those for whose opinions I entertain much regard, that I was induced to defer this course, they being of opinion that such a step at that moment might prove prejudicial to the interests of the Company. Having, after mature deliberation, come to the conclusion that any further delay of an appeal to the Shareholders would be regarded as a great dereliction of duty on my part, I informed the Board on the 7th inst. of my intention to do so, and at the same time stated, that I could not consent to retain the chair longer than the period necessary for the election of my successor.

BUCKLAND ABBEY,
November 20, 1848.

A D D R E S S,

ETC.

It will probably occur to some of my readers to inquire the reasons which have induced me to obtrude the following pages on the attention of the Proprietary. I would reply by simply referring them to the third section of the Directors' report, read to the half-yearly meeting of shareholders, held at Plymouth on the 29th of August last, by the adoption of which report it was virtually decided to abandon the atmospheric system of traction on the South Devon line. I have been induced to undertake a task, which I would gladly have avoided, from the knowledge that the meeting adopted the report in the absence of that information which could alone enable them to form a correct judgment, as well as from the firm conviction that such a measure was fraught with serious evils, and might ultimately prove ruinous to the interests of the Company. I felt also that the responsibility which devolved upon myself, as chairman of the Board of Directors, rendered it incumbent upon me to lay before the shareholders the

facts which have compelled me to draw conclusions so greatly at variance with those of eleven of my colleagues. Having discharged this duty, I am content to leave the further consideration of the subject to the proprietary, in whose ultimate decision upon the merits of the whole case I shall readily acquiesce. My individual interest in the line, as a holder of fifty whole, and fifty half shares, is not sufficiently large to justify my opposing the abandonment of the atmospheric system, when convinced that the measure has been sanctioned by the shareholders, after an opportunity has been afforded them of weighing the facts and evidence upon which my own opinions are based. I shall, however, be at all times ready to use my best exertions in redeeming the past, and in providing for the contingencies of the future.

The third section of the report to which I have referred is as follows:—"In regard to the cost of working the atmospheric system upon the upper portion of the line, it has been, throughout the whole of the period to which the accounts refer, so much greater than your Directors had had reason to anticipate, that although certain reductions have latterly attended the progress of the experiment, and others to a considerable extent might probably be relied upon, yet your Directors found it necessary to refer the investigation of the whole of this momentous subject to the special consideration of a committee, who have for many weeks most anxiously

devoted their time and utmost attention to it. After most earnestly balancing the various circumstances and considerations which the labours of that committee have placed before the board, your Directors, without pronouncing any judgment as to the ultimate success of the atmospheric system, and whilst they are prepared to afford to the patentees and other parties interested in it the use of the machinery for continuing their own experiments, have arrived at the conclusion, with the entire concurrence and on the recommendation of Mr. Brunel, that it is expedient for them to suspend the use of the atmospheric system, until the same shall be made efficient at the expense of the patentees and Mr. Samuda. The board are prepared with arrangements for supplying locomotive power from the date of the suspension of the atmospheric system."

The committee referred to in the foregoing report consisted of four members, viz., the chairman of the South Devon, the chairman of the Great Western, and the chairman of the Bristol and Exeter board, with the addition of Mr. Woolcombe, a director of the South Devon Railway. The first act of the committee was to call upon the engineer for a comprehensive report on the subject, which he accordingly furnished^a.

The result of a long and laborious investigation of the various documents prepared for the committee, has firmly established in my mind the following pro-

^a See Appendix, No. 3.

positions:—*Firstly*, that owing to the sharp curves throughout the line, and the steep gradients on that part of it between Newton and Plymouth, the atmospheric system of traction is peculiarly applicable to the South Devon Line; and, if not indispensable to its safe and efficient working, it possesses, from the absence of all danger of collision, an essential advantage over the locomotive for a single line of rails^a. *Secondly*, that the weight of documentary and other evidence, in reference to the future economy of the working cost of the two systems, is decidedly in favour of the atmospheric^b. *Thirdly*, that the abandonment of the atmospheric system would necessarily involve the loss of nearly 300,000*l.*, and thereby entail a perpetual unproductive charge for interest of about 15,000*l.* per annum^c. *Fourthly*, that as all the engines for working the line to Plymouth, as well as those for the Torquay branch, are on the eve of completion, the one intended to work the Dainton inclines being already fixed, and the tubes laid, it is essentially important that a trial should be given to the system over the steep gradients^d, in accordance with the desire of the shareholders expressed at the half-yearly meeting held in February last. *Fifthly*, that the offer of Mr. Samuda^e to effect the repairs and improvements in the longitudinal valve, suggested in the engineer's report to the committee, and

^a See Appendix, Nos. 1. 3.

^b *Ibid.*, 3. 9. 10. 11.

^c *Ibid.*, 8.

^d *Ibid.*, 1. 3.

^e *Ibid.*, 4.

to keep the same in good working condition at a moderate and fixed charge for a period of twelve months, would make it highly desirable to continue the system at least for that period. *Sixthly*, that if locomotive power be substituted, a due regard for the security of the passengers, added to the increasing traffic for goods, will render it absolutely necessary that a double line of rails should be laid throughout, for which purpose a large expenditure will be inevitable. *Seventhly*, that unless the Company are willing to pay the Great Western Company a charge, equal to 1s. 6d. per train mile on that part of the line between Exeter and Newton, and about 1s. 9d. per train mile between Newton and Plymouth, for the use of their engines, a further sum will be required to provide a locomotive plant, with its necessary buildings; and, lastly, that the finances of the Company, after the completion of the line into Plymouth, and the Torquay branch, and having a due regard to their liabilities, will not admit of any additional expenditure.

From the foregoing propositions it would appear that, considering the immense sums already expended upon this system of traction, the enormous loss that would result from its abandonment, and the additional expenditure necessarily involved in the change, it would be most judicious to make such arrangements with Mr. Samuda as might enable the Company to continue the working of the line between Exeter and Newton, and also to work the inclined

planes between Newton and Totness, for such a limited period as would afford an opportunity of judging—first, whether such a reduction in the working cost can be realized as would make it expedient to continue the system; and, secondly, as to the adaptation of the system to the steep gradients, provided the same could be accomplished at a moderate additional charge. In the meantime all further expenditure on the remaining part of the line should be suspended. Such were the conclusions to which I had arrived. I regret, however, to say, that the chairman of the Great Western and the chairman of the Bristol and Exeter took a different view of the subject, and were prepared to recommend to the South Devon Directors the immediate and total abandonment of the system, unless Mr. Samuda, or the patentees, would enter into a contract to work the line at their own cost and risk. The engineer having already informed us that there was not the remotest probability that either of these parties would accede to such a proposition, this proviso was evidently nugatory and delusive. Anxious to avoid a result so prejudicial to the interest of the Company as a division in the committee on so important an inquiry, I endeavoured by every means consistent with my own convictions and my duty to the shareholders, to reconcile our views so far as would enable us to present a united report. Several meetings were held for the attainment of this object. Mr. Woolcombe and myself had a meeting with Mr.

Samuda, to ascertain if he would adopt the engineer's suggested improvement in the longitudinal valve. To this he agreed, upon terms which we considered fair and reasonable; and, having succeeded in this important point, we were under the impression that we had thus secured the unanimous decision of the committee, and therefore prepared a report which we believed would meet the approval of our colleagues^a.

The committee met at Teignmouth on the same morning, subsequently to our interview with Mr. Samuda. On reading our report, I was greatly surprised to hear from the engineer, who was present, that he had no confidence in Mr. Samuda's longitudinal valve, or in any alteration of it, and therefore he could not recommend the continuance of the atmospheric system upon the South Devon line. I was utterly at a loss to account for the expression of sentiments so decidedly adverse to those contained in his written reports, and I could not refrain from noticing to him this discrepancy in his opinions. His reply was, that I had put a wrong construction upon his report.

This document^b will, however, speak for itself; and I must leave it to the shareholders to decide whether my views were not fully warranted by the unequivocal expressions which they contain.

On hearing this declaration of the engineer, Mr.

^a See Appendix, No. 5.

^b Ibid., No. 3.

Woolcombe, who had agreed with me thus far, stated that, if the engineer had lost all confidence in the valve, he could no longer oppose the abandonment of the system.

Had I consulted merely my own ease and desire for unanimity, I should have pursued the same course; but, as I found it impossible to reconcile the engineer's present statement with the opinions which he had so clearly expressed, I had no other alternative than to adhere to the report proposed by Mr. Woolcombe and myself. My colleagues, however, declined to receive it, and proposed another, which had been prepared by the Secretary to the Great Western Company, recommending an immediate and total abandonment of the system^a. All prospect of unanimity being thus at an end, no course was left open to us other than that of each member of the committee submitting his view to the Board of Directors, and leaving the question to their decision. Several hours were thus occupied in the evening previous to, as well as on the morning of the general meeting of shareholders.

I may here state, for the information of those who are unacquainted with the constitution of the Board of Directors of the South Devon Railway, that it originally consisted of twenty-one members; viz.,

^a It may be right to observe that both the Secretary of the Great Western Company and the engineer were present at all the meetings of the committee.

eleven representing the interest held by the associated companies, and ten elected by the remaining shareholders :—thus,

Five from the Bristol and Exeter Board, representing 4000 shares.

Four from the Great Western Board, representing 3000 shares.

Two from the Bristol and Gloucester Board, representing 1000 shares.

Ten from the other shareholders, representing 12,000 shares.

The Bristol and Gloucester Company having sold their line to the Midland Company, ceased to be Directors of the South Devon Line, conformably to the provisions of the Act, and as yet none have been appointed in their room. The Directors now representing the general body of shareholders are—Mr. Gill (the chairman), Lord Seymour (who does not attend the meetings of the board), Lord Courtenay, Sir Anthony Buller, Colonel Harris, Mr. Rundle, Mr. St. Aubyn, Mr. Derry, Mr. Cole, and Mr. Woolcombe. The resolution which had been proposed in committee by the chairman of the Great Western and the chairman of the Bristol and Exeter, was, with some modifications, introduced by Lord Courtenay to the South Devon Board^a, on the morning of the general meeting of shareholders, and, after considerable discussion, ultimately carried by eleven votes out of eighteen: viz.,

^a See Appendix, No. 6.

The Great Western Directors.	. 4 in number.
The Bristol and Exeter ditto .	. 5 „
Lord Courtenay, (who is also a Director on the Bristol and Exeter Board)	. . . . . 1 „
Mr. Woolcombe . . . . .	. 1 „

 11

Sir Anthony Buller, Col. Harris, Mr. St. Aubyn, Mr. Rundle, Mr. Derry, and Mr. Cole, together with myself, declined to vote upon the question. Thus, with the exception of one Director representing the general body of shareholders, this resolution was carried by those either interested in, or representing the interests of, the associated companies*.

During the several meetings of the committee, I had repeatedly observed that the experience of the last six months, viz., from the 1st of January to the 5th of July, did not afford a fair criterion either of the efficiency or of the economy of the system;

* Should it hereafter appear that the continuance of the atmospheric system was incompatible with views which the associated boards may entertain in reference to the South Devon Line, it is by no means improbable that, influenced by an involuntary bias, they have been induced to regard the success of this Company in only a secondary point of view.

These companies collectively represent an interest of 350,000*l.* at the South Devon Board, whilst they are the representatives at their own respective boards of an aggregate of from 12,000,000*l.* to 13,000,000*l.*

that during the months of June, July, and August, when the interruptions occasioned by the repairs and alterations in the engines and apparatus were become less frequent, the trains had been running with great regularity, and a gradual and steady reduction in the working charges had taken place^a, clearly indicating such a reasonable prospect of ultimate success as would justify its continuance for at least a limited period. And further, that, although the atmospheric system had not been adopted without the express recommendation of the engineer^b, I could not but feel that the Directors had, by giving it their sanction, incurred a very serious responsibility, and therefore declared that nothing short of a written statement from him, recommending its discontinuance, and showing the grounds for advice so diametrically opposed to his reports, would induce me to entertain the question of its discontinuance, without first appealing to a general meeting of shareholders, when information might be laid before them which would enable them to decide on the expediency of such a course. A written statement of this nature has never been received. When, therefore, the resolution moved by Lord Courtenay was passed by the board, I stated that, as it appeared to me to be unjust to call upon the shareholders to acquiesce, without examination, in a measure of such importance, it would be my duty to lay the whole case before the meeting.

^a See Appendix, No. 9.

^b Ibid., No. 1.

I left the board room to arrange my papers for that purpose. In a few minutes a resolution^a was transmitted to me from the board, "deprecating all discussion on the respective merits of the atmospheric and locomotive systems." This I was at first disinclined to notice, but subsequently resolved to comply with the request, so far as not to volunteer a statement. Should the shareholders call for any explanation on the subject, I was determined to carry out my first intention. It happened that the first speaker who addressed the chair put such questions in reference to the atmospheric system as obliged me in my reply to allude to it; upon which the chairman of the Great Western made some remarks relative to my being the only dissentient at the board. This rendered it necessary that I should at once explain the whole subject; and I was about to do so, when a Director of the Midland Company (Mr. Ellis) proposed that all explanations should be avoided. As no dissent was expressed to this at the time, I acquiesced in what then appeared to be the general wish of the meeting. I was, however, wrong in this supposition. Several shareholders present at the meeting, and others who were absent, have since expressed a strong desire that the proprietors should be made acquainted with all the facts, and that a special general meeting should be convened to reconsider the subject. I have been induced to enter thus minutely into this part of the proceedings by

^a See Appendix, No. 7.

the desire of showing that, had I then been permitted to make my intended statement, the present address might have been unnecessary.

I will now proceed to lay before you the data upon which my own opinions as to the ultimate success of the atmospheric system on the South Devon Line are founded. On a reference to the revenue account in the Directors' report, it will be seen that the working cost of the locomotive system, from the 1st of January to the 5th of July, 1848, was 5218*l.* 10*s.* 5*d.*, and that of the atmospheric 11,138*l.* 19*s.* 10*d.*, which sums, severally divided by the number of train miles performed by each system, gives 2*s.* 4½*d.* per train mile for the locomotive, and 3*s.* 1½*d.* per train mile for the atmospheric. It will therefore be incumbent upon me to show the manner in which the working of the latter system has so far exceeded 1*s.* per train mile (the original estimate of the engineer).

Throughout the months of January and February the locomotive and atmospheric systems were worked as far as Teignmouth concurrently, consequently the atmospheric trains were few. It is well known that the working cost of this system diminishes as the number of trains is increased; and it is obvious that, since the same establishment, and nearly the same quantity of fuel is required for a small as for a large number of trains, the charges for these months must have greatly exceeded the sum which

under other circumstances would have been the ordinary cost.

Soon after the atmospheric apparatus was put into operation it was discovered that all the engines were, from their mal-construction, more or less inadequate to the duty required of them, particularly the Dawlish engine, which has invariably consumed from 40 to 50 per cent. more of fuel than the others. They were originally designed to work at a speed of from 18 to 20 strokes per minute, but it was found necessary to work them from 25 to 30, and even more. These imperfections in the engines and other parts of the apparatus required extensive alteration, which could only be effected during the ordinary traffic of the line, thereby causing serious impediment and obstruction to its regular working. Whilst these numerous alterations and repairs were in progress, the weekly charge for labour was also largely increased by the employment of a number of extra men on various parts of the line, which would have been unnecessary had the machinery been perfect; this additional expense, therefore, can form no part of the ordinary working cost of the system.

It was considered necessary, with a view to economize the use of fuel, that expansion gear should be applied to each engine. It was also essential, in order to diminish the period of actual duty of each engine, that the electric telegraph should communicate with every engine station, by which a consider-

able saving of coal would be effected. Both these improvements were ordered to be completed some months since. The expansion gear has been applied to one engine only, and there with great advantage. The telegraph, having been placed in each engine room, was found to be imperfect, and it was not until the 2nd of August that it worked with full efficiency.

From this period to the 9th of September (when the system was discontinued) it will be seen, on referring to Appendix No. 9, that a rapid and steady reduction occurred in the consumption of fuel, viz.:

From	2 to 16 Aug.,	427 tons =	30 10 per diem.
„	16 to 30 „	415 „	29 13 „
„	30 to 9 Sept.,	287 „	28 14 „

Whilst the average quantity used from the 2nd of March (the time when the atmospheric system began to work alone) to the 2nd of August was 563 tons for each fortnight, equivalent to 40 tons per diem. The comparison shows a reduction exceeding 25 per cent. from the period when the telegraph was effectively employed.

Then with regard to the cost of coal, an article which forms the most important item in the working charge of this system: the description hitherto used is the Merthyr steam coal, which, delivered at Bridgewater, costs 12s. 6d. per ton, to which add 1s. 6d. per ton for the use of trucks, and 3s. 6d. per ton carriage to Exeter, amounting altogether to 17s. 6d. per ton. Now there is no doubt that this charge may

be reduced from 12 to 15 per cent.:—1st, in the price of coal; 2ndly, in the expense of transit, by delivering it at Teignmouth instead of Bridgewater, thus saving at least 1s. 6d. per ton on all the coal required at the Newton, Summer House, Teignmouth, and Dawlish stations, as well as at the Dainton and Totness; 3rdly, instead of hiring trucks at 1s. 6d. per ton, fully 1s. per ton might be saved by using our own. Trucks were ordered to be made many months since, but none have yet been delivered. A considerable reduction in the charges was also anticipated from the erection of workshops for making a part of the apparatus, as well as for general repairs. Extensive buildings have been lately erected at Newton for this purpose.

The reasons I have here enumerated will, I think, be sufficient to account for the excess of expenditure on the atmospheric during the six months included in the Directors' revenue report. I would appeal to the common sense of every man whose mind is free from bias on this subject, whether under such a state of things as I have described any just estimate of the value of this system could be formed, either as to the cost of working, or the regularity of the trains. Would it not have evinced a more earnest desire to arrive at correct conclusions had a period been selected when the interruptions and increased charges occasioned by the alterations in progress were on the wane? A reference to the Appendix, No. 9, will show that from the 8th of June to the 9th of

September a considerable reduction had taken place in the working expenses, and much greater regularity was observable in the running of the trains^a. Is it then too much to infer that, as soon as the various alterations were completed, and the longitudinal valve put into good repair, the working cost would have been brought within the limit named by the engineer, viz., 1s. per train mile, and thus the grand desideratum of a system, comprising the advantages of greater security to the passengers, and of an economy yielding a larger dividend to the shareholders than I fear can ever be hoped for from the locomotive, might ultimately be attained? Many of my readers cannot fail to recollect the great and numerous difficulties which the able projector of the locomotive system had to encounter, all of which, by perseverance and energy, he happily surmounted. And what are the real obstacles which now oppose the progress of the atmospheric system? No one has ever attempted to impugn the principle. The difficulties are purely mechanical; the greater part of these have been already conquered; the only remaining one of any importance, viz., the longitudinal valve, is, according to the engineer's report, "susceptible of great improvement." A reference to Appendix No. 4 will show that Mr. Samuda was willing to undertake and complete such improvements to the satisfaction of the engineer. Is it then unreasonable to assume that the result would have proved successful? But,

^a Appendix, No. 12.

even had it been otherwise, will any man acquainted with the science of mechanics be bold enough to assert that no valve sufficiently perfect could be constructed? Several have been already submitted for consideration and trial by their inventors; none but that of Mr. Samuda has been used or tested on the South Devon Line, although some of those proposed seem to possess elements of success sufficient to recommend them to notice. The experience of almost every other railway company proves that the first year of opening a line, especially when only partially opened, is invariably far more expensive than succeeding years, and therefore no Board of Directors would consider themselves warranted in taking the first year as a criterion of its average working cost. A majority of the South Devon Board has, however, determined to discard a system upon which so large an outlay has been made, the precipitate abandonment of which involves so ruinous a loss, after an imperfect trial of only six months, under disadvantages which will not find a parallel on any line in the kingdom. I have now only to refer my readers to the documentary evidence in the Appendix, in support and confirmation of all that has been advanced, and I hope that every candid and impartial mind will be satisfied that no statement has been made which is not in its utmost latitude justified.

Should the shareholders generally, after the perusal of these pages, entertain the opinion that before the atmospheric system is irrevocably abandoned it would

be a wiser course to hazard a further expenditure of a sum of about 6000*L.*, rather than incur the certainty of a positive loss of at least 300,000*L.*, added to the necessity of a further expenditure of from 300,000*L.* to 400,000*L.*, then I must inform them that they should lose no time in giving expression to their opinions, by calling an extraordinary general meeting^a for the reconsideration of the subject. A part of the atmospheric property has already been advertised for sale, and it is intended to dispose of the remainder as soon as the requisite arrangements can be completed. If, on the contrary, the shareholders consider that the recommendation of the Directors to abandon the atmospheric system, as reported to the last half-yearly meeting, is that which is most consistent with the interests of the Company, I have only to add that, with the conscious feeling of having faithfully discharged an important duty to the pro-

^a Clause 72 of the Act of Incorporation : — And be it enacted, that it shall be lawful for twenty or more shareholders, holding in the aggregate one thousand shares, to the amount of fifty thousand pounds, by writing under their hands, at any time to require the directors to call an extraordinary meeting of the Company; and such requisition shall fully express the object of the meeting required to be called, and shall be left at the office of the Company, or given to at least three directors, or left at their usual place of abode; and forthwith upon the receipt of such requisition the directors shall convene a meeting of the shareholders; and if, for twenty-one days after such notice, the directors fail to call such meeting, the said number of shareholders, qualified as aforesaid, may call such meeting by giving fourteen days' public notice thereof.

prietary, I shall acquiesce in that decision. That the atmospheric system of traction will yet triumph over all opposition I feel firmly persuaded, and it is this persuasion that has given me so much anxiety, lest it should hereafter be said that, having first concurred in its adoption, I had, without sufficient consideration, also concurred in its rejection, and consequently been instrumental in inflicting upon the shareholders a ruinous and irretrievable loss. It must, however, be remembered, that such a decision will render it almost imperative, in order to avoid the excessive expenditure which must necessarily be incurred in widening the tunnels, the viaducts, and other parts of the line, and in an application to parliament for powers to purchase more lands to form a double *wide* gauge, that the South Devon Railway be reduced to a double *narrow* gauge line.

Having thus afforded to the proprietors an opportunity not only to form correct views of the past, the present, and the future, but of giving expression to those views, I would offer for their consideration some suggestions which have occurred to my own mind, in reference to the course it may under all the circumstances be most advisable to adopt.

1st. The atmospheric system having been suspended, it would not be wise to recommence working before the whole of the apparatus and machinery is put into that perfect condition which shall ensure its working economically and with regularity. To accomplish this, let the Dawlish engine be removed,

and another of greater power (already made and paid for) be erected in its stead. Let Mr. Samuda's offer to alter, repair, and maintain the longitudinal valve be accepted; and I would further recommend that a cover be placed over the valve, which will protect it from the heat of the sun, the rain, and frost, all of which proved so prejudicial to the former valve.

All alterations to the other engines having been completed, excepting the application of expansion gear, which would be a trivial affair both in time and cost, no other expenditure would be required upon the line between Exeter and Newton.

With regard to the inclines between Newton and Totness, the Dainton engine could be completed in a month, the rails are all laid, and both are paid for.

As to the outlay requisite to effect this, I have the engineer's authority for saying, that the cost for removing the engine at Dawlish, and erecting another, including masonry, will not exceed 1500*l.*, which sum would be returned in 12 months: from the reduced consumption of fuel, the saving in that time would be equal to 1600 tons^a.

The cost of the longitudinal valve would be, for 20 miles, at 210*l.* per mile, 4200*l.*, one-half only of which is to be paid, should it be decided, after 12 months' working, that the system shall be abandoned.

The total amount that would be hazarded by a further experiment for 12 months may thus be stated:

^a See Appendix, No. 13.

3000*l.* if it succeeds, or 4000*l.* should it prove unsuccessful. If a cover to the valve be added, that would form an extra charge, but I believe that an inexpensive one might be made.

Should these suggestions be adopted, it is important that the arrangements necessary for giving effect to them should have immediate attention, as the light rail intended for atmospheric working sustains much injury from heavy locomotives running over it; and, if long continued, new rails will be required. Mr. Samuda's offer to complete the valve in 12 months, was under the impression that the atmospheric system would be continued, and consequently he would have been subject to much interruption. There is no doubt that he might now complete the 20 miles in a much shorter period.

From this it is evident that, with the expenditure of a sum equal to six shillings per share, if 6000*l.* be required, a further experience of this system for 12 months, under the most favourable circumstances, may be obtained, which in all probability will prevent the loss of 300,000*l.* (equal to 15*l.* per share), and place this undertaking in a position from which the most sanguine hopes as to its future success might be realized.

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| 1st, | from the 1st January to the 1st March, 1848. |
| 2nd, | " 1st March " 24th May, " |
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APPENDIX.

No. I.

COPY of MR. BRUNEL'S REPORT on the Atmospheric System.

SOUTH DEVON RAILWAY,
August 19th, 1844.

GENTLEMEN,

I have given much consideration to the question referred to me by you at your last meeting, namely, that of the advantage of the application of the atmospheric system to the South Devon Railway.

The question is not new to me, as I have foreseen the possibility of its arising, and have frequently considered it.

I shall assume, and I am not aware that it is disputed by anybody, that stationary power, if freed from the weight and friction of any medium of communication, as a rope, must be cheaper, is more under command, and is susceptible of producing much higher speeds than locomotive power; and when it is considered that for high speeds, such as sixty miles per hour, the locomotive engine with its tender cannot weigh much less than half the gross weight of the train, the advantage and economy of dispensing with the necessity of putting this great weight also in motion will be evident.

I must assume also that, as a means of applying stationary power, the atmospheric system has been successful, and that, unless when under some very peculiar circumstances it is inapplicable, it is a good and economical mode of applying stationary power ; I am aware that this opinion is directly opposed to that of Mr. Robert Stephenson, who has written and published an elaborate statement of experiments and calculations founded upon them, the result of which support his opinion. It does *not seem to me* that *we can* obtain the minute data required for the mathematical investigation of such a question, and that such calculations, dependent as they are upon an unattained precision in experiments, are as likely to lead you very far from the truth as not.

By the same mode Messrs. Mallett, and other French engineers, have proved the success of the system, and by the same mode of investigation Dr. Lardner arrived at all those results regarding steam navigation, and the speed to be attained on railways, which have since proved so erroneous.

Experience has led me to prefer what some may consider a more superficial, but what I should call a more general and broader view, and more capable of embracing all the conditions of the question—a *practical* view.

Having considered the subject for several years past, I have cautiously, and without any cause for a favourable bias, formed an opinion, which subsequent experiments at Dalkey have fully proved to be correct—viz., that the mere mechanical difficulties can be overcome, and that the full effort of the partial vacuum produced by an air-pump can be communicated, without any loss or friction worth taking into consideration, by a piston attached to the train.

In this point of view the experiment at Dalkey has entirely succeeded ; a system of machinery, which even at the first attempt works without interruption constantly for many months, may be considered practically to be free

from any mechanical objection. No locomotive line that I have been connected with has been equally free from accidents. That which is true for one railway of two miles in length is equally true for a second or third, although they may be placed the one at the end of the other; the chances of an accident are only in the proportion of the number, or, in other words, the length—a proportion which holds equally good with locomotives, except that a locomotive may be affected by the distance it has previously run, while a stationary engine and its pipes cannot in like manner be affected by the previous working of the neighbouring engine and pipes.

In my opinion the atmospheric system is, so far as *any stationary power* can be, as applicable to a great length of line as it is to a short one.

Upon all these points I could advance many arguments and many proofs; but I shall content myself with saying, that, as a professional man, I express a decided opinion that, as a mechanical contrivance, the atmospheric apparatus has succeeded perfectly, as an effective means of working trains, whether on long or short lines, at higher velocities and with less chance of interruption, by stationary power, than is now effected by locomotives.

I will now proceed to consider the question of the advantage of its application to the South Devon Railway.

It will simplify the discussion of the question very much, if it is considered as a comparison between a double line worked by locomotives in the usual manner, and a single line of railway worked by stationary power; the only peculiarity of the present case being that, upon four separate portions of the whole fifty-two miles, stationary assistant power would under any circumstance have been used—these four inclines forming together one-fifth of the whole distance.

It is necessary to consider it as a question of a single line on account of the expense; the cost of the pipe for each line being about £3,500 per mile, an addition of

£7,000 per mile, or of about £330,000 in the first construction, could not be counterbalanced by any adequate advantage in the saving in the works on the South Devon Railway, and probably not by any subsequent economy or advantage in the working. But the system admits of the working with a single line, certainly without danger of collision, even with less than upon a double locomotive line; and I believe also, that, considering the absence of most of the causes of accidents, there will even be less liability to interruption, and less delay on the average resulting from accidents, than with an ordinary double locomotive railway.

By the modification of the gradients, and by reducing the curves to 1,000 feet radius, where any great advantage can be gained by so doing, and by constructing the cutting, embankments, tunnels, and viaducts for a single line, a considerable saving may be effected in the first cost.

In the permanent way and ballasting, the reduction will be about one-half. I should propose to make the rails about 52 lbs. weight, and the timber 12 ft. 6 in.; the quantity of ballast would probably be rather more than half; but, at the present prices of iron and timber, the saving could not be less than £2,500 per mile. From a careful revision of the works generally, I consider that a reduction may be effected in the following items, and to the amount specified in each, viz., ballasting gradients and curves:—

Reduction in earthwork	£16,500
Do. in length of principal tunnels	14,000
Saving by single line:—	
Earthwork	25,000
Tunnels	11,000
Viaducts	15,000
Permanent way and ballast:—	
To allow for sidings, fifty miles, at £2,500	125,000
	<hr/>
	£207,000

Per Contra.

Pipe on $41\frac{1}{2}$ miles	£138,500
Increase on incline planes, $10\frac{1}{2}$ miles, at £600	£6,500—£145,000
Engines for the $41\frac{1}{2}$ miles	35,000
Patent right—say	10,000
	<hr/>
	£190,000

The difference in first cost, therefore, is £17,000.

To this must, however, be added the cost of locomotive power, with its attendant expenses of engine houses, &c. &c., which cannot, I think, be put at less than— £50,000
Making a saving— 67,000

I have not included in the expense of the Atmospheric Apparatus that of the telegraph, because, at its present reduced cost of £160 per mile, I am convinced its use would repay the outlay in either case.

It would appear, then, that the line can be constructed and furnished with the moving power in working order, on the atmospheric system, for something less than the construction only of the railway fitted for locomotive power, but without the engines, and that, taking into consideration the cost of locomotive power, a saving in the first outlay may be effected of upwards of £60,000.

But it is in the subsequent working the advantages will be most sensible.

In the first place, with the gradients and curves of the South Devon Railway, a speed of thirty miles per hour would have been for locomotives a high speed, and under unfavourable circumstances of weather and of load it would probably have been found difficult and expensive to have maintained even this; with the atmospheric and with the dimensions of pipes, I have assumed a speed of forty to fifty miles may certainly be depended upon, and I have no doubt that from twenty-five to thirty-five minutes may be saved in the journey.

Secondly. The cost of running a few additional trains, so far as the power is concerned, is so small, the plant of engines, the attendance of engine-men, &c., remaining the same, that it may almost be neglected in the calculation; so that short trains or extra trains, with more frequent departures, adapted in every respect to the varying demands of the public, can be worked at a very moderate cost; and I have no doubt a considerable augmentation of the general traffic thus effected, by means which, with locomotive engines, would be very expensive, and frequently unattainable, particularly as regards one class of short trains, whether for passengers or goods, which, from the inconvenience of working them by locomotives, are hardly known.

I refer to trains between the intermediate stations. By many means, which the easy command of a motive power at any time at every part of a line must afford of accommodating the public, I believe the traffic may be increased.

It appears to me also that the quality of the travelling will be much improved; that we shall attain greater speed, less noise and motion, and an absence of the coke dust, which is certainly still a great nuisance, and will be inducements thus held out to those (the majority of travellers) who travel either wholly for pleasure, or at least not from necessity, and who are mainly influenced by the degree of comfort with which they can go from place to place.

Lastly. The average cost of working the trains will be much less than by locomotives, with the gradients of the South Devon Railway, and assuming that not less than eight trains, including mail and goods trains, running the whole distance, and certainly one short train running half the distance, to be the least number that would suffice; I think an annual saving of £8000 a year in locomotive expenses (including allowance for depreciation of plant) may safely be relied upon.

For all the reasons above quoted, I have no hesitation in

taking upon myself the full and certain responsibility of recommending the adoption of the atmospheric system on the South Devon Railway, and of recommending, as a consequence, that the line and works should be constructed for a single line only,—

I have the honour to be,
Gentlemen,

Your obedient Servant,

(Signed)

I. K. BRUNEL.

Note.—Censure having been unsparingly bestowed on the Directors for having sanctioned the application of the Atmospheric System to the South Devon Line, I have considered it due to them to place this document before the Shareholders, not from a desire to shift any part of the blame which may fairly attach to them, but merely to correct erroneous impressions. With such a report before them, would the Directors have been free from the imputation of presumption had they resisted the recommendation of a man so eminently qualified to give sound advice upon a subject that “was not new to him, and which he had frequently considered?” Would they not have incurred a heavy responsibility had they refused to adopt a system that promised so fair, and from which “a saving of £8000 per annum in locomotive expenses (including allowance for depreciation of plant) might safely be relied on?”

No. II.

EXTRACT FROM ENGINEER'S REPORT to the DIRECTORS,
at the Half-Yearly Meeting of Shareholders, Feb. 29,
1848.

Duke Street, 26th Feb., 1848.

Notwithstanding numerous difficulties, I think we are in a fair way of shortly overcoming the mechanical defects, and bringing the whole apparatus into regular and efficient practical working, and as soon as we can obtain good and

efficient telegraphic communication between the engine houses, and thus insure proper regularity in the working of the engines, we shall be enabled to test the economy of working. *At present this is impossible, owing to the want of the telegraph compelling us to keep the engines almost constantly at work*, for which the boiler power was not intended and is insufficient, and the consequence is that we are not only working the engines *nearly double the time that is required*, but, the boilers being insufficient for such a supply of steam, the fires are obliged to be forced, *and the consumption of fuel is irregular and excessive*. There is every prospect of this evil being speedily removed, and as the working of the atmospheric will then become the subject of actual experiment, and its value be practically tested, I shall refrain from offering at present any further observations upon it.

The engine house at the Summit at Dainton, between Newton and Totnes, is completed: preparations are making for erecting the engines, and the pipes are being laid upon the line.

Note.—From this extract it appears, even in February last,

“That the mechanical defects had not been overcome;”

“That the telegraphic communication between the engine houses had not been effected;”

“That it was at present impossible to test the economy of working;”

“That the engines were working double the time that was required;”

“That the fires were obliged to be forced;”

“That the consumption of fuel was irregular and excessive.”

With these various imperfections and impediments, some of which were not remedied before July and August, will any one affirm that it was just to select a period of so much embarrassment and interruption for deciding upon the value of the Atmospheric System? Was it right to appeal to a meeting of Shareholders, with minds quite unprepared, for their approval of such a decision?

No. III.

MR. BRUNEL'S REPORT to the COMMITTEE, August 19th,
1848.

It should be observed that the engineer has presented to the Committee three reports. As there are not any essential variations in them, I have thought it right to give the last, and to refer by marginal notes to those alterations which appear to deserve notice.

18, Duke Street, Westminster,
19th August, 1848.

GENTLEMEN,

You have called upon me to report to you upon the present state of the Atmospheric Apparatus, and particularly upon the circumstances connected with the partial destruction of the longitudinal valve which has lately occurred, and the probability of remedying this serious defect, and of keeping the valve in repair and in good working order.

Such a report involves necessarily the consideration of the whole question of our experience of the working of the atmospheric system; because, to arrive at any clear appreciation of the present state of the apparatus, I must refer to the circumstances which have affected our working up to the present time; and particularly to the several difficulties which we have had to encounter, and their effects.

The first difficulty, and one which was as unexpected as it was serious, was the working of our stationary engines: upon the efficiency of these machines must of course depend the economy and efficiency of the working of the whole system, however perfect in itself might be the atmospheric apparatus.

Accordingly, great precautions were taken—precautions which I still think were such as to justify the expectation that we should secure the best engines that could be made.

The three first manufacturers of the day were employed:

Messrs. Maudeslay, who had had some experience in this particular branch, having made the engines for the Croydon Railway; Messrs. Boulton and Watts, and Messrs. Rennie. They prepared their own designs, and I know that they each bestowed much thought in the preparation of these designs, and took considerable interest in the results.

Mr. Samuda, a man of considerable mechanical abilities, having all the experience that could be had on the subject, and deeply interested in the success of the engines, was also employed to superintend their manufacture.

Notwithstanding all these precautions, notwithstanding excellent workmanship, these engines have not, on the whole, proved successful. None of them have as yet worked very economically, and some are very extravagant in the consumption of fuel, burning nearly double the quantity of others, while the average is very considerably more than it ought to be.

The apparent causes of this excess are various in the different engines; but all resulting more or less apparently from the want of experience in this particular application of power, and from the circumstance of the form of the engines being somewhat novel, and involving slight differences in the proportion and arrangement of the parts; and, the consumption of steam being greater than was calculated upon, it has been obtained by a more wasteful expenditure of fuel, and the evil has been aggravated.

The difficulty of remedying this state of things has been increased by the consequence of defects in the atmospheric apparatus, which, causing a much greater demand upon the working of the engines, has delayed, or has entirely prevented, our throwing an engine out of work to introduce the requisite improvements; still, so far as this defect in the engines is concerned, *there is no doubt that it is susceptible of considerable if not complete remedy, and that a reduction of one-third may be effected in the consumption of fuel.*

In the atmospheric apparatus itself our difficulties have been more numerous.

We have suffered from extreme cold, particularly when it followed quickly upon wet.

We have suffered from extreme heat, and also from heavy falls of rain. These difficulties have in turn been encountered and gradually overcome; and I think the effects of all these causes *upon a valve in good condition may now be obviated*, if not *entirely*, yet so much so as to render their operation *unimportant*.

The same remedy applies to all three: keeping the leather of the valve oiled and varnished, and rendering it impervious to the water, which otherwise soaks through it in wet weather, or which freezes it in cold, rendering it too stiff to shut down; and the same precaution prevents the leather being dried up and shrivelled by the heat, for this, and not the melting of the composition, is the principal inconvenience resulting from heat. A little water spread on the valve from a tank in the piston-carriage has also been found to be useful in very dry weather, showing that the dryness, and not the heat, was the cause of leakage; but a new difficulty has arisen, and a new defect has been discovered,—one much more serious in its extent and in its possible consequences, and one which renders the operation of each of the previously mentioned causes of difficulty much more powerful and mischievous.

Within the last few months, but more particularly during the dry weather of the last May and June, a considerable extent of longitudinal valve failed by the tearing of the leather at the joints between the plates; the leather first partially cracked at these points, which caused a considerable leakage, particularly in dry weather; after a time it tears completely through, and that part of the valve is destroyed and requires to be replaced.

A considerable extent has thus been replaced (*1); but the whole of the valve is more or less defective from this

cause; the amount of leakage is considerable, and the working altogether inefficient.

I have examined carefully portions of the valve that have been removed, and I find that at the part which has given way the texture of the leather seems to be destroyed; it is black, and has evidently been acted upon by the iron of the plates.

Upon some parts of the line the injury seems to be more general than upon others; but it is very difficult to examine the valve in place, so as to form any correct opinion of the extent of the evil.

As regards the cause of this defect, Mr. Samuda, who under his contract is at present liable for the repair of the valve, urges that the valve was kept for a length of time in cases after it was delivered to the Company, and that, exposed to damp, and the oil in the leather not being renewed on the surface, the iron may have rusted, and the leather have been injured; and he refers to instances lately observed in which valves, taken out of the top of a case which had been exposed to wet, do show similar signs of injury. Supposing this assumption to be correct, however, it would not seem to affect the question of his liability. He suggests also as a cause, that the valve remained for a length of time in a place without being used, and even worked over by locomotive engines, which prevented its being properly oiled and attended to: that the evil has been aggravated by an attempt to reduce too much the use of oil to the leather; and, lastly, that the piston gear has been allowed to get out of adjustment, so that the leather of the valve has been unduly strained.

I shall not, however, here enter into the discussion of this question of liability, but confine myself to the consideration of the evil, and the possibility of remedying it.

Of the extent of the evil, for the reason I have given, it is impossible to form any accurate opinion; it is impossible, therefore, to say it does not extend more or less over

the whole distance, excepting, of course, that which has been already replaced. That which is injured cannot be repaired in place, but must be removed; and the remedy can only be applied in the new valve.

It is quite possible that a valve made in the same manner as the present, if properly attended to, from the first and with our present experience, might not be subject to this destruction, and Mr. Samuda states that such is the case at Dalkey; but I do not think I could rely upon this result.

By painting, but better still by zincing or galvanising the iron plates, and making them overlap a short distance, both the chemical and the mechanical action of the plate upon the leather appears to be prevented; and I believe, therefore, that this evil may be remedied at a small increased cost in any new or repaired valve that might be laid down; but of the existing valve I can say no more than I have done (*2). It is not now in good working condition, and I see no immediate prospect of its being rendered so.

From the foregoing observations, it will be evident that I cannot consider the result of our experience of the working between Exeter and Newton such as to induce me to recommend the extension of the system. I believe that (*3) *if the longitudinal valve were restored the working expenses might be immensely reduced*; that the *quantity of fuel consumed*, which is the great item of expense, *may be diminished by one-third*; that the *price of the fuel*, which now costs 18s. *per ton* at the engine houses, *ought to be reduced at least twelve per cent.*; and that *the total cost* may thus be *brought down to a moderate amount*, such as I had originally calculated upon (*4); but the cost of construction has far exceeded our expectations, and the difficulties of working a system so totally different from that to which everybody—traveller as well as workman—is accustomed, have proved too great; and therefore,

although no doubt, after *some further trial, great deductions may be effected* in the cost of working (*5) the portion now laid, I cannot anticipate the possibility of any inducement to continue the system beyond Newton (*6).

(*7). With respect to the future working of the apparatus between Exeter and Newton, I feel in great difficulty as to expressing any opinion, seeing that a very large expense has been incurred, and believing as I do that the cost of working may be so very much reduced; but that reduction can only be effected by the almost entire renewal of the valve, and by some expenditure in the engines; and unless Mr. Samuda or the patentees undertake the first and extend considerably the period during which they would maintain it in repair, and unless they can offer some guarantee for the efficiency of that valve, I fear that the company would not be justified in taking that upon themselves or incurring the expense attending the alteration of the engines.

I believe that for the inclined planes as an assistant power (*8) the apparatus will be found applicable and efficient, and, as the engines and pipes are nearly ready (*9) at Dainton, it may be found desirable to try it there, provided a satisfactory arrangement can be entered into for the maintenance and efficiency of the valve.

I have not referred to our great disappointment in not obtaining *the assistance of the telegraph in the working of the engines*, and *the great increased consumption of coal consequent upon the working the engines unnecessarily*, because this evil is now nearly removed; but some further reductions may still be made by using the telegraph by night as well as day, which it has not yet been in our power to do, but which I trust will be commenced this week.

I am, Gentlemen,

Your obedient Servant,

To the Directors of the (Signed) I. K. BRUNEL.
South Devon Railway Company.

- *1. *Not in the former reports*, "but the whole of the valve is more or less defective from this cause ; the amount of leakage is considerable, and the working altogether inefficient."
- *2. "It is not now in good working condition, and I see no immediate prospect of its being rendered so."
- *3. "If the longitudinal valve were restored."
- *4. In the first report, but omitted in this, "within 1s. per train mile."
- *5. In the former report, after the word working, was the following : "which may make it worth while to continue the working of the line between Exeter and Newton."
- *6. In the former report the words were, "to extend it to Plymouth."
- *7. The whole of this sentence omitted in the former reports.
- *8. In the former reports the words were, "there can be no doubt of its applicability and efficiency."
- *9. In the former reports the words were, "I should recommend that the works on the Dainton incline should be completed, confining it however to the inclined plane." The subsequent proviso *not* in the former reports.

No. IV.

MR. SAMUDA to the CHAIRMAN.

London Street, Aug. 26, 1848.

MY DEAR SIR—

Referring to our conversation on the 23rd, respecting the proposal that I then informed you I had sent to Mr. Brunel, I have thought over the suggestions you then made, and, with the view to meet them as nearly as I can, I would propose,—That the longitudinal valve between Exeter and Newton be now furnished with such alterations and additions as our present experience shows advisable, viz., with additional plates, to take the strain off the leather, painted to prevent rust, and with a layer of prepared canvas under the top and over the bottom plate, to keep the iron plates from immediate contact with the leather ; gal-

vanised rivets, using the present leather when suitable and having new substituted whenever the present is unsuitable.

I will undertake to maintain in good working order (such maintenance not to include repair from accidents), to Mr. Brunel's satisfaction, the longitudinal valve between Exeter and Newton for twelve months from now, and to make such alterations and additions as before described, in the first instance, in such portions of the line as I shall find require it the most, such portions not reaching over less in the whole, than an aggregate length of ten miles within the next six months, and ten additional miles (or the remaining portion) in the then succeeding six months.

The alterations and additions to be made equal to a sample of about 500 feet in length, to be approved by Mr. Brunel, for the sum of £210 per mile, viz., £105 to be paid me so soon as each mile of altered valve is delivered and laid down, and the remaining £105 at the expiration of twelve months from the present time.

If Mr. Brunel should prefer having the whole or any of the plates galvanised instead of painted, as proposed, I will get them galvanised, the Company paying the difference of expense involved on each portion as delivered.

At the end of twelve months, the Company shall give me notice if they intend to discontinue the working of this portion of the line atmospherically, and, if they then do so discontinue, I shall not be entitled to receive the £105 per mile received on ten miles of such portion as shall then have been put down, and only so much of the remainder as Mr. Brunel should, under the circumstances, think fair, and the company shall, after such notice, have no claim on me for further maintenance of valve; but, if the company do not give me such notice, the remaining £105 on the whole twenty miles shall be paid at the expiration of twelve months from the present time.

In adjusting this matter, it is to be understood that I will furnish to the Company, without charge, a quantity of valve

corresponding with the quantity which has been used by the Company in repairs, and for which I have been paid (exclusive of the reserve), such quantity of new valve not to exceed in any event a length of six miles: but any improvements or additions with which such new valve may be furnished shall be paid for on Mr. Brunel's estimate, as provided in my contract of 20th February, 1845. The old valve removed to make way for the valve so used by the Company in repairs, to be returned to me.

It must be perfectly understood that a part of the terms for which I stipulate in the present arrangement is, that such of my accounts against the company to the present time as have not been already passed, are to be passed, and the periods of payment of the whole adjusted.*

As agreed between us, this letter is to be received by the Company without prejudice.

I am, Dear Sir,

Yours faithfully,

JOSEPH D'A. SAMUDA.

* *Note.*—The accounts for which Mr. Samuda stipulates, showed a balance due to him of £2709 14s. 11d., with a condition that he should be entitled to deliver six miles of longitudinal valve in lieu of that which had been used, or would be required for the repair of the old valve. Since the rejection of his proposals, he has sent in claims upon the Company amounting to about £14,000, besides the right to deliver the six miles of valve, or to receive compensation in lieu thereof. These claims are not admitted by the Board.

NO. V.

PROPOSED REPORT of the COMMITTEE by the CHAIRMAN
and MR. WOOLLCOMBE.

That after having given every consideration to the report which Mr. Brunel has made on the Atmospheric System, and the various statements of the working ex-

penses, your Committee regret having to report that the experiment, so far as it has proceeded, has proved most unsatisfactory; and they think that nothing less than an assurance that the working expenses are susceptible of great reduction would justify them in recommending the continuance of the experiment.

At the same time, having reference to the immense outlay which has been incurred, the large amount which must be required in addition, if the locomotive system be adopted, and the opinion of Mr. Brunel, that the working expenses are susceptible of "great reduction," your Committee cannot reconcile to themselves any hasty abandonment of the Atmospheric System. They are therefore of opinion that, provided satisfactory arrangements could be made with Mr. Samuda or the patentees, it would be unwise to refuse incurring a moderate outlay for a further trial of the experiment for twelve months.

Your Committee, under these circumstances, recommend that you authorise them to negotiate with Mr. Samuda and the patentees, and that you meet specially on the 9th September, to consider the result of the treaty.

No. VI.

The RESOLUTION proposed by LORD COURTENAY at the Board, on the 29th of August, 1848.

RESOLVED—

That, the very heavy expenses incurred in working the Atmospheric Principle between Exeter and Newton, arising in part from the imperfect state and rapid decay of the longitudinal valve, and in part from other causes affecting the system, render it necessary to suspend the employment

of it at the charge of this Company, until the patentees and Mr. Samuda shall have adopted some means, to the satisfaction of the Directors, for relieving the Company from the loss consequent upon working under such disadvantages.

That, in adopting the foregoing resolution, it should be understood, that the directors are not to be precluded from contributing some reasonable and fixed pecuniary amount, such as may seem proper to the Board, in order to assist Mr. Samuda and the patentees in carrying out any improvement which the engineers may consider likely to afford to the Company the means of beneficially resuming the use of the atmospheric system.

Note.—The period when Mr. Samuda was required to give an answer to the above resolution was restricted to the 6th September (or eight days).

No. VII.

RESOLUTION of the BOARD.

RESOLVED—

That, in the opinion of this Board, it will be most essential to the interests of the Company, that in the statement from the chair all discussion of the atmospheric and locomotive system should be avoided, and that the shareholders should be informed that the legal questions at issue render it essential that no discussion whatever should take place at the meeting.

No. VIII.

A DETAILED STATEMENT of the EXPENDITURE upon the Atmospheric System, to Nov. 1st, 1848, the amount remaining to be paid, and an estimate of the value of the Materials if sold.

	Cost.			Estimate of the value if sold.		
	£.	s.	d.	£.	s.	d.
Pipes and Iron, including fixing, &c. }	183,000	0	0	26,725	0	0
Preparation on Ditto	9,200	0	0	"	"	"
Longitudinal Valve .	27,976	0	0	500	0	0
Section Valves . .	3,843	0	0	200	0	0
Apparatus . . .	1,315	0	0	"	"	"
Piston Gear . . .	2,738	0	0	200	0	0
Management, &c. .	2,347	0	0	"	"	"
Machinery and Tools	1,274	0	0	200	0	0
Engine Houses . .	38,032	0	0	1,000	0	0
Engines	98,693	0	0	32,897	0	0
	368,418	0	0			
To pay on Engines	19,500	0	0	6,500	0	0
Ditto Contractors & others . . }	45,000	0	0	6,000	0	0
	432,918	0	0	74,222	0	0

No. IX.

STATEMENT, showing the nett working cost, per Train Mile, of the Atmospheric System, extracted from the accounts of the Superintendent of that department, as submitted to the Board every fortnight, from the 1st January, to the 9th September, 1848* :—

First, from January 1st, to March 1st, when the two systems were working concurrently—

	<i>s.</i>	<i>d.</i>	
Jan. 1 to 26	3	2½	
February 2	3	1	
16	3	0	
23	2	11½	
March 1	2	11¾	
	15	2½	Average 3 <i>s.</i> 0½ <i>d.</i> per mile.

Second, from March 1st, to May 24th—

March 15	2	8	
29	2	9	
April 12	3	1½	
26	2	1½	
May 10	2	11½	
24	2	2	
	15	9½	Average 2 <i>s.</i> 7½ <i>d.</i> per mile.

Third, from May 24th, to August 2nd—

June 7	2	7½	
21	2	0½	
July 5	1	10	
19	2	4½	
August 2	2	3	
	11	1½	Average 2 <i>s.</i> 2¾ <i>d.</i> per mile.

* The charges for the repairs of the longitudinal valve are excluded: these are to be repaid by Mr. Samuda, according to contract.

Fourth, August 2nd, to September 9th—

August 16	.	2	0
30	.	1	11
September 9	.	1	9½

5 8½ Average 1s. 11d. per mile.

The telegraphic communication was complete on the 2nd August.

Thus, within six months, the working cost was reduced 38 per cent.; and, at the period of its discontinuance, a gradual reduction was going on.

No. X.

LOCOMOTIVE CHARGES.

The Locomotive Engines were running over the Line thus:—

	Miles.	Average Working Cost per Train Mile.
From Jan. 1 to March 1, Exeter to Totness	22¾	.. 2s. 5¼d.
„ March 1 to May 5, Newton to Totness	8¾	.. 2 8
„ May 5 to June 30, Newton to Lara	.. 30	.. 1 11

From January 1 to June 30,

No. of Miles of Passenger and Goods Trains.	Working Cost.	Average Per Train Mile.
43,393	£5218.	2s. 4⅞d.

No. XI.

REPORT from the SUPERINTENDENT of the Atmospheric Department.

Newton, August 12th, 1848.

MY DEAR SIR,

In forming the inclosed estimate of the probable cost of working the Atmospheric Apparatus between Exeter and Newton, I have carefully considered the working during the last three months, and have taken the data chiefly

from the working between the 8th and 21st June, as I find the weather was more favourable for the longitudinal valve during that fortnight, and consequently the consumption of coal per hour less than in any other. Perhaps it may be considered that the average of several fortnights would have been a more correct estimate; but as the longitudinal valve, even at the best of times, is very defective, I think it may easily be assumed that, with a more perfect valve, the consumption of coal may be reduced to the lowest average, more especially as the engines will admit of considerable improvements. I have, therefore, taken the average of Exeter, Countess Weir, Turf, Starcross, Teignmouth, Summer House, and Newton, which gives 5.8 cwt. per hour of actual duty per single engine: this is high, as compared with the consumption by the Cornish engines; but more extra consumption over the Cornish engines is necessary, in consequence of the fires being under the boilers for so much longer a period than the engines work.

I have left Dawlish out altogether, as additional power will be necessary to reduce the consumption to the average of the other engines.

The longitudinal valve may, I feel confident, be improved so as to reduce the regulated duty as follows:—

	For Down Trains, Engines start—		
	At present.	May be reduced	
	m.	m.	
Exeter . . .	5	to 3	before departure of trains
C. Weir . . .	5	„ 3	before commencing to pull train
Turf . . .	6	„ 4	„ „ „ „
Star Cross . .	6	„ 4	„ „ „ „
Dawlish . . .	8	„ 4	„ „ „ „
Teignmouth .	8	„ 4	„ „ „ „
S. House . . .	6	„ 4	„ „ „ „
Newton . . .	6	„ 4	„ „ „ „

For Up Trains, Engines start—			
	At present.	May be reduced	
	m.	m.	
Newton . . .	5	to 3	before departure of trains
S. House . . .	5	„ 3	before commencing to pull trains
Teignmouth . .	6	„ 5	„ „ „ „
Dawlish . . .	8	„ 4	„ „ „ „
Star Cross . . .	8	„ 4	„ „ „ „
Turf . . .	6	„ 4	„ „ „ „
C. Weir . . .	6	„ 4	„ „ „ „
Exeter . . .	6	„ 4	„ „ „ „

	Regulated for 6923 Miles.				Consumption of Coal at 5.8 cwt. per hour.	
	From the 8th to 21st June		May be reduced to			
	h.	m.	h.	m.	Tons.	Cwt.
Exeter . . .	124	30	110	24	31	18
C. Weir . . .	166	35	143	12	41	9
Turf . . .	139	37	124	40	35	19
Star Cross . .	175	47	168	18	48	14
Dawlish . . .	210	23	180	46	52	4
Teignmouth .	180	35	167	30	48	8
S. House . . .	124	37	107	2	31	0
Newton . . .	105	0	84	42	24	8
Total					314	0

If, by the Company having their own coal trucks, the Great Western Company will carry for one penny per ton per mile, the cost of the coal will be 16s. per ton.

By strengthening and improving the piston gear, I think the maintenance may be reduced to £18 per fortnight*.

I have assumed the section valves to be worked by the police.

* The present cost averaging about £45 per fortnight.

The cost of working 6923 miles will then be as follows :—

	£	s.	d.
314 tons of coal, at 16s.	251	4	0
Wages of engine men and stokers .	76	0	0
Coal premiums	2	0	0
Maintenance of engines and stores*	24	0	0
Wages of train	15	19	0
Unloading 314 tons coal, at 4d. .	5	4	8
Maintenance of piston gear † . .	18	0	0
Main tube	8	0	0
Longitudinal valve	25	0	0
Manufactory and tools	3	0	0
Management	14	0	0
Cleaning pistons	2	15	0
	<hr/>		
	£445	2	8‡

I think we have not had sufficient experience to know to what extent the cost of working may be reduced ; but I have no doubt myself but that the expenditure may be reduced as above, and if the longitudinal valve can be made practically tight, (and I see no reason why it should not), the cost may be still further reduced.

It is very likely the improvements in the engines will reduce the consumption of the coal to something less than 5.8 cwt. per hour ; but, as the average from the 8th to the 21st June gives a favourable result in the above account, it is perhaps better to assume the consumption at 5.8 cwt. per hour.

The saving in the wear and tear of the rail must reduce the cost of maintenance of way very much.

I beg to remain, my dear Sir,

Your most obedient Servant,

(Signed) JAMES PEARSON.

I. K. BRUNEL, Esq., &c.

* The average cost from 1st March to 30th June was £79.

† The average cost from ditto to ditto „ £47.

‡ Equal to 1s. 3½d. per Train Mile.

No. XII.

SUMMARY of ATMOSPHERIC TRAINS, Running Time.

Date.	Trains.	Miles.	Running time.		Gain.			Loss.		
			Allowed.	Actual.	Trains.	Miles.	H. M.	Trains.	Miles.	H. M.
1848. Weeks ending										
May 11	132	2491½	93 58	99 39	55	927	2 59	77	1564½	8 40
18	136	2572½	96 49	101 42	60	1084	4 25	76	1488½	9 18
25	136	2572½	94 50	91 56	88	1641	7 4	48	931½	4 10
June 1	136	2572½	94 50	96 57	65	1206½	3 25	71	1366	5 32
8	136	2572½	94 50	93 1	87	1609½	5 18	49	936	3 29
15	136	2572½	94 50	96 39	74	1348½	5 7	62	1224	6 56
22	136	2572½	94 50	94 32	78	1408½	4 36	58	1164	4 18
29	136	2572½	94 50	92 39	89	1625½	5 22	47	947	3 11
July 6	136	2572½	96 39	94 24	89	1626	6 3	47	946½	3 48
13	136	2572½	97 1	100 54	62	1156½	3 46	74	1416	7 39
20	136	2572½	97 1	104 53	53	1042	3 9	83	1530½	11 1
27	136	2572½	97 1	98 32	65	1200	4 14	71	1372½	5 45
	1628	30789	1147 29	1165 48	865	15875	55 28	763	14914	73 47

This statement exhibits a degree of regularity in the running time of the trains, which without any undue assumption may challenge a comparison with any of the best lines.

Result upon 1628 trains, a loss of 73 hours 47 minutes, or 2½ minutes per train; and a gain of 55 hours, 28 minutes, or two minutes per train.

No. XIII.

STATEMENT, 1st, The Consumption of Coal by the Eight Engines from Exeter to Newton, from 1st March to 2nd August.

2nd, Ditto by the Seven Engines (excluding the Dawlish), for the same period.

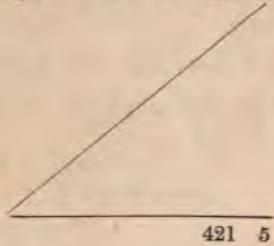
3rd, 1st and 2nd repeated from the 2nd August to the 9th September, when the Telegraph was in full operation.

EIGHT ENGINES.		SEVEN ENGINES.	
	Tons. Cwt.		Tons. Cwt.
1st to 15th March ...	607 10	.....	471 16
29th „	559 11	.....	441 1
12th April.....	627 10	.....	507 4
26th „	472 —	.....	371 15
10th May	611 15	.....	474 5
24th „	586 15	.....	468 15
7th June.....	567 10	.....	438 5
21st „	483 —	.....	372 4
5th July	528 11	.....	417 1
19th „	581 —	.....	453 16
2nd August...	574 0	.....	438 5
	11) 6199 2		11) 4854 7
Average of each fortnight.....	563 11	Average of each fortnight for 7 engines	441 3
		Do. for 1 engine....	63 0
		Do. for 8 engines...	504 0
		Excess of consumption by the Dawlish engine for each fortnight...	59 11
	563 11		563 11

EIGHT ENGINES.

	Tons.	Cwt.
2nd to 16th August..	427	5
16th to 30th "	415	5
	2)	842 10

Average for each fortnight . . . 421 5



30th Aug. to 9th Sept. 287 tons.
28 tons 14 cwt. per diem.

SEVEN ENGINES.

	Tons.	Cwt.
.....	335	15
.....	308	10
	2)	644 5

Average for each fortnight7) 322 2

Do. for 1 engine, do. 46 0

Do. for 8 engines, do. 368 2

Excess of consumption by the Dawlish engine for each fortnight ... 53 3

421 5

30th Aug. to 9th Sept. the excess of Dawlish for ten days, 38 tons.

RESULTS.

Assuming that the Dawlish Engine was removed :

	Tons.
Consumption from March 1st to August 2nd, per fortnight ...	504
" from August 2nd to August 30th "	421
The saving since efficient working of the Telegraph	83

No. XIV.

STATEMENT showing the quantity and cost of coal actually consumed by the Eight Engines, between Exeter and Newton, from the 1st March to the 9th September :—

Deductions.	To Coal, 7,329 tons, at 17s. 6d.	£6413 0 0
See page 17.	By 12½ per cent. on the cost	£801 12 6
See Appendix, No. 13.	By the excess of the Dawlish engine from 1st March to 2nd August, 655 tons, at 17s. 6d.	573 2 6
	Carry forward	£1374 15 0
		£6413 0 0

		£	s.	d.	£	s.	d.
Deductions.		Brought forward...		1374	15	0	6413 0 0
See Appen-	By the excess of the Dawlish						
dix, No. 13.	engine from August 2nd to						
	Sept. 9th, 144 tons 12 cwt.						
	at 17s. 6d.	126	10	6			
Do. do.	By the excess of consumption						
	on all the engines from 1st						
	March to the 2nd August,						
	as compared with that be-						
	tween the 2nd and 30th						
	August, say on eleven fort-						
	nights at 83 tons, equal to						
	913 tons at 17s. 6d.	798	17	6			
					2300	3	0
					£4112	17	0

2nd. The nett cost of all wages and stores within the same period £4801 0 0

Deductions.

See Appen-	By a reduction in the charge			
dix, No. 11.	for piston gear, 27 weeks			
	at £29	783	0	0
Do. do.	By ditto on the charge for			
	maintenance of engines			
	and stores, 27 weeks at			
	£55	1485	0	0
		<hr/>	2268	0 0
			£2533	0 0

The reduction on coal equal to 36 per cent.

Do. on maintenance, &c., equal to 47 per cent.

The reductions on coal are based on the result of the five weeks' work after the telegraph was in full operation. At this time, owing to the defective state of the longitudinal valve, a considerable leakage was unavoidable; which circumstance imposed on the engines great additional duty, and consequently a much larger consumption of fuel. The waste would be from fifteen to twenty per cent., which would have been saved when the valve was repaired.

No. XVI.
PROSPECTIVE VALUE of the SOUTH DEVON LINE within Twelve Months after the Opening of the Line
into Plymouth, and the Branch to Torquay.

No. 1.		No. 2.	
Interest on the preferential half shares, £500,000 at 6 per cent.	30,000	To charge as above	
To Interest on Debentures, say £500,000 at 5 per cent.	25,000 — 55,000	To Cost of Working by Locomotives, at 50 per cent.*	55,000
To Cost of Working by Atmospheric, at 40 per cent.	62,400	To Interest on the Whole Shares, at 2½ per cent.	78,000
To Dividend on the whole Shares, say £1,000,000 at 4 per cent.	40,000		25,000
	<u>£157,400</u>		<u>158,000</u>
By Passenger Traffic, 2500 per week +	£130,000		
By Goods. " 500 "	26,000		
	<u>£156,000</u>		
			<u>£156,000</u>
			Brought down from above

Note.—If the Line had been made within the original Estimate, a Dividend of about 9 per cent., if worked by Atmospheric, or 7½ per cent. by Locomotives might have been expected.

* Owing to the steep gradients on the lower part of the Line, it is believed that the cost will be 50 per cent. if worked by Locomotives, as assistant power will be necessary.

+ The Passenger Traffic from the 4th August to the 22nd September averages £1790 per week, and the Goods Traffic has already reached nearly £200 per week since the Line was opened to Lara, which station is from two to three miles from Plymouth, and four to five from Devonport.

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GEORGE WOODFALL AND SON,
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